HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Big Beef Creek Fall Chinook Program
Species or Hatchery Stock:	Big Beef Fall Chinook (O. tshawytscha) Hood Canal
Agency/Operator:	University of Washington
Watershed and Region:	Big Beef Creek, Hood Canal Puget Sound
Date Submitted:	August 23, 2002
Date Last Updated:	August 20, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Big Beef Fall Chinook Project

1.2) Species and population (or stock) under propagation, and ESA status.

Chinook Salmon, *Oncorhyncus tshawytscha*, Big Beef Creek stock. Although Puget Sound chinook are listed as threatened, this program uses only hatchery origin stock, which are not considered part of the listed population.

1.3) Responsible organization and individuals

UW On-Site Contact Name (and title):
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Hood Canal Salmon Enhancement Group; funds approx. 50% of the hatchery program
University of Washington; funds 50% of the project and is the hatchery landowner for Big Beef Creek; uses chinook at Big Beef Creek for research.

HCSEG Administrative contact:
Neil Werner, Facilitator
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National Marine Fisheries Service (NMFS) Manchester scientists have used Big Beef Chinook for research.

Washington Department of Fish and Wildlife (WDFW) have used Big Beef Chinook for research.

The technical work group that oversees project and guides policy, made up of representatives from: WDFW, NMFS, USFWS, Pt. No Pt. Treaty Tribes, Skokomish Tribe, HCSEG, LLTK.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

HCSEG funding source is WDFW "RFEG Funds" and pays tank and water rental fees to the UW for a total of $14,700/year; up to four part-time volunteers help operations on a seasonal basis. UW state funding through the School of Fisheries covers .4 FTE of time for Gordon George to operate the hatchery year-around for a cost of $18,166 (includes benefits). Total costs for hatchery program operations is $32,866.

1.5) Location(s) of hatchery and associated facilities.

The Big Beef Creek Project is located at a man-made hatchery, pond and experimental channel complex on the north side of Big Beef Creek, Rkm 0.1, in the Hood Canal Basin, in Washington State. The project is located in Section 15, T25N, R1W. Hatchery facilities are physiographically and hydrologically isolated from the natural stretches of Big Beef Creek; water used in the hatchery facilities for incubation and tank flow is from a 350′ freshwater production well.

1.6) Type of program.

Isolated harvest.

1.7) Purpose (Goal) of program.

The Big Beef Creek Project is an augmentation, research and education program. The goal of this program is to use artificial production to increase harvestable numbers of chinook salmon in an area where the natural freshwater production capacity is limited; provide chinook for research for UW, WDFW, NMFS and other interested collaborators; and provide an opportunity for salmon education for local communities and schools.

1.8) Justification for the program.

The Big Beef Creek Project will provide harvest in Hood Canal, North of Seabeck. To reduce adverse effects on listed fish, all chinook that return to Big Beef Creek will be captured at the weir, placed in tanks within the hatchery facilities, and isolated from other species. They will not be allowed to naturally spawn within Big Beef Creek. In addition to providing harvest, the project has been used to provide a vigorous healthy stock of research fish for use by NMFS, WDFW, UW and other interested collaborators. These studies can benefit listed fish by exploring different ways to artificially propagate hatchery fish, enhance juvenile survival through pre-release conditioning to natural stressors (predation, natural forage, environmental conditions), and experimentation to investigate stage-specific shifts in habitat use, feeding, and vulnerability to different predators.

1.9) List of program "Performance Standards".

1.10) List of program "Performance Indicators".

Performance Standards and Indicators for Puget Sound **Isolated Harvest** Chinook programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch and cwt data
Meet hatchery production goals Provide fish for research	Number of juvenile fish released **– 200,000** Number of fish supplied for research	Future Brood Document (FBD) and hatchery records
Manage for adequate escapement where applicable	Hatchery return rates	Hatchery return records

Minimize interactions with listed fish through proper broodstock management and mass marking. Maximize hatchery adult capture effectiveness. Use only hatchery fish	Number of broodstock collected - **140**	Rack counts and CWT data
	Stray Rates – **cwt to allow for evaluation of releases**	Spawning guidelines
	Sex ratios	Hatchery records
	Age structure	
	Timing of adult collection/spawning **– mid-September to end of October**	Spawning guidelines Hatchery records
	Adherence to spawning guidelines	
	Total number of wild adults passed upstream - **0**	
Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Out-migration timing of listed fish / hatchery fish – **April –early June / first week of May**	FBD and historic natural outmigration times
	Size and time of release – **80 fpp/first week of May release**	FBD and hatchery records CWT data, mark/unmark ratios
	Hatchery stray rates – **cwt to allow for evaluation of releases**	
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	

Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy
	Fish pathologists will diagnose fish health problems and minimize their impact	Fish Health Monitoring Records
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES reports

Benefits Addressed:

1) Achieve broodstock collection/eggtake goals to provide fish for stable, predictable fisheries.

2) Communicate within WDFW and with the tribes, citizen groups, schools, private citizens and federal agencies regarding program goals and production objectives.

3) Meet Endangered Species Act recovery requirements and Wild Salmonid Policy guidelines.

4) Provide fish carcasses for nutrient enhancement programs in Hood Canal.

5). Have hatchery chinook available for research studies by UW, WDFW, and NMFS.

6). Provide local educational and community participation opportunities.

Risks Addressed

:

1) Reduce hatchery broodstock collection impacts on wild fish by;
initiating mass marking of hatchery chinook and;
returning wild fish entering the hatchery back to the river or stream.

2) Reduce interactions between hatchery and wild juvenile fish.

3) Maintain hatchery stock integrity and genetic diversity by;
continuing the policy of releasing no out-of-basin fall chinook from Hood Canal hatcheries or into Hood Canal streams and;
collecting sufficient broodstock to meet or exceed numbers of fish required to minimize effects of genetic drift and;
Insuring that bias in taking broodstock is minimized, e.g. by taking fish throughout the run, by avoiding selection for size, incorporating some jacks into the broodstock.

4) Meet disease prevention and control standards in the Co-Manager's Salmonid Disease Control Policy.

5) Meet or exceed state and federal water-quality standards for hatchery discharge.

1.10.1) "Performance Indicators" addressing benefits.

1) Monitor the number of returning adults and eggtakes weekly to determine whether goals are being met.

2) Publish agreed-to production plans (Future Brood Document) with PNPTC tribes and other stakeholders.

3) Acquire needed permits (e.g. approved HGMP) to ensure that the Hood Canal fingerling fall chinook program satisfies ESA recovery requirements for listed fish.

4). Hatchery chinook will be available for studies by UW, WDFW, and NMFS.

5). Studies will be included in the annual project report.

6). The release date of Big Beef chinook will be a celebration of salmon for local communities.

7). Local grade school and high school students will attend hatchery chinook spawning operations to learn about modern hatchery practices.

8). Local grade school and high school students will collect data on sex, length, weight, fecundity, and reproductive effort for spawned hatchery chinook for comparison with future returning adults to document any phenotypic changes in the population.

9). All hatchery chinook will be virologically tested and, with permission of the Co-Managers, carcasses can be used for co-op projects with various schools and other groups for distribution into various Hood Canal tributaries for nutrient loading.

1.10.2) "Performance Indicators" addressing risks.

1). All hatchery chinook will be adipose fin clipped or tagged upon request by the Co-Managers to allow for distinction between hatchery chinook and naturally spawning chinook upon return as adults at the Big Beef weir.

2). All hatchery chinook will be captured at the Big Beef weir to prevent them from entering Big Beef Creek, in order to reduce the risk of adverse effects on wild populations.

3). Hatchery chinook smolt-to-adult return rates will be evaluated.

4). The number of adults used in the hatchery project will meet or exceed the minimum population size.
5). Adult chinook will be collected for spawning over the entire duration of the run to ensure that differences in return timing are preserved in the population.

6). Genetic Stock Identification (GSI) allozyme collections will be taken from all hatchery chinook spawned for comparison with future generations to monitor allelic characteristics.

7). DNA samples will be collected and archived for future analysis.

8). HCSEG/UW will determine the survival at various egg and juvenile life stages.

a)Determine green egg to eyed egg, eyed egg to swim up fry, and swim up fry to released fry survival rates for Big Beef hatchery chinook.

b)Maintain and compile records of culture techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for chinook brood stock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods for 5-7 gram fry.

c) Summarize results of tasks for presentation in annual reports.

d) Identify where the hatchery program is not meeting objectives, and make recommendations for improvements as needed.

9).HCSEG/UW will determine if hatchery stock procurement methods are collecting the required number of adults that represent the demographics of the population with minimal injuries and stress to the fish.

a) Monitor operation of adult capture operations, ensuring compliance with established broodstock collection protocols.

b) Monitor timing, duration, composition, and magnitude of the run.

c) Collect biological information on collection-related mortalities and determine causes of mortality, and use carcasses for genetic stock profile sampling, if possible.

d) Summarize results for presentation in annual reports and provide recommendations on means to improve stock collection, and refine protocols if needed for application in subsequent seasons.

10)HCSEG/UW will monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists of the USFWS will monitor fish health.

a) A fish health specialist will conduct fish health monitoring. Significant fish mortality to unknown causes will be sampled for histopathological study.

b) The incidence of viral pathogens in hatchery chinook will be determined by sampling fish at spawning in accordance with procedures set forth in the "Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (WDFW 1996).

c) Fish health monitoring results will be summarized in the annual report. HCSEG/UW will collect age, sex, length, weight, fecundity, GSI, and DNA from a representative sample of hatchery stock for use as baseline data to document phenotypic changes in the population.

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The maximum number of adults spawned is 70 pairs.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Life Stage	Release Location	Annual Release Level
Eyed Eggs	n/a	none
Unfed Fry	n/a	none
Fry	n/a	none
Fingerling	Big Beef Creek Estuary	200,000
Yearling	n/a	None

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Currently, there is very little available data except for escapement levels.

Year	Smolts released	Escapement
1990	6500	8
1991	62,000	60
1992	70,000	20
1993	32,000	36
1994	55,000	60
1995	200,000	472
1996	180,000	268
1997	140,000	156
1998	200,000	236
1999	200,000	1000

1.13) Date program started (years in operation), or is expected to start.

The current HCSEG/UW partnership project started during the fall of 1990. Chinook research hatchery operations at Big Beef Creek had been ongoing since 1972 but had declined due to lack of funding.

1.14) Expected duration of program.

Ongoing for research and education.

1.15) Watersheds targeted by program.

Big Beef Creek, WRIA 15.0389

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

Big Beef hatchery chinook could spawn naturally in Big Beef Creek above the weir to provide production for harvest, research, and education, however, this is not allowed by the Co-Managers and does not comply with their impending Puget Sound Chinook Plan. In the past, the research and education portions of the program could be duplicated by using eggs or fish provided annually by either George Adams or Hoodsport hatcheries.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Currently, there are no ESA permits in hand due to the new ESA listings for Puget Sound chinook and Hood Canal summer chum.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

- Identify the ESA-listed population(s) that will be directly affected by the program.

There is no ESA listed population directly affected.

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

It is conceivable that this project may incidentally impact threatened Hood Canal summer chum, threatened Puget Sound chinook, and bull trout.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds

Big Beef summer chum are part of the listed "threatened" Hood Canal summer chum ESU (NMFS FRN 1999). The Co-Managers designated the Big Beef summer chum population as "extinct" with a "high" potential for successful re-introduction in the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000). A re-introduction project began with brood year 1996 using broodstock from the Big Quilcene/Little Quilcene stock. The first returns came in 1999. There were four summer chum that returned, none of which was able to spawn.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

The natural Hood Canal summer chum population was extirpated from Big Beef Creek since 1984.

Quilcene origin Summer Chum released:

Year	Smolts released
1997	200,000
1998	110,00
1999	200,000
2000	40,000

Source: Steve Schroder, WDFW, written comm. and Summer Chum HGMP

Puget Sound Chinook released: see Section 1.12 above

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Hood Canal Summer Chum Spawning Abundance:

- The average escapement from 1974-78 was 6,497.
- The average escapement from 1990-94 was 156.
- The average escapement from 1995-96 was 690.

(Unpublished WDFW data, "Artificial Production and Evaluation Plan for Summer Chum Salmon Populations).

Puget Sound Chinook spawning abundance**:** see section 1.12 above.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

There is very little data available. Summer chum have not been observed at Big Beef Creek since 1984 (Summer Chum Conservancy Plan, WDFW 1999). A summer chum hatchery effort was started in 1996, in which Quilcene summer chum were re-introduced to Big Beef Creek. To date there are no naturally producing summer chum in Big Beef Creek; hatchery origin (artificially propagated) summer chum make up 100% of the summer chum population at Big Beef Creek.

There have been no documented studies of Puget Sound chinook successfully spawning in the estuary below the weir. This is probably due to the low probability of egg-to-fry survival due to salinity-induced osmotic shock. In addition, burial and scour below the weir by gravel bedload and sediment transported into the estuary make the environment extremely unstable and unsuitable for egg survival.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

A very likely take will be in the form of human activity near the listed species, during freshwater residency. This activity includes, but is not limited to; installing adult monitoring equipment and capturing adults in weir trap.

WDFW operates the UW weir on Big Beef Creek for evaluation and monitoring of coho salmon. The weir is also the means of capturing broodstock for the Hood Canal summer chum reintroduction program and for the Big Beef chinook project in order to prevent chinook migration into Big Beef Creek. The Big Beef weir has a "high" potential to take listed Hood Canal summer chum through migrational delay, capture, handling, and upstream release, during trap operation. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation. Summer chum encountered in the traps will either be released upstream above the Big Beef Creek weir, transported via tank truck for release into the renovated spawning channel, or retained (up to 100) for spawning for the on-going reintroduction program.

Listed fish may also spawn below Big Beef weir, which may lead to a take. If listed summer chum spawn in the estuary below the weir and hatchery-origin chinook spawn there as well, the superimposition of redds may cause a take of listed Hood Canal summer chum. Natural sediment transport processes during heavy rains cause gravel from Big Beef Creek to be transported below the weir and will destroy eggs of any fish that have spawned below it. Saltwater incursion into the estuary up to the weir during high tides would also destroy eggs spawned below the weir due to osmotic shock.

The weir causes substrate accretion in the stream channel for a significant distance upstream. This is creating a potential flooding hazard to the grounds of the Big Beef Creek Station, which includes the summer chum rearing facility. However, this weir is crucial for intercepting summer chum broodstock, assessing upstream migrants, preventing upstream migration of hatchery chinook salmon, and has been a key element of WDFW's wild coho smolt outmigration index stream program.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Hood Canal summer chum were extirpated from Big Beef Creek in 1984 and since then there were no returning adult summer chum. After initiation of the Quilcene/Big Beef re-introduction project in 1996 there was a very limited return in 1999. In 1999, four summer chum returned to Big Beef: one female that had already spawned (may have spawned below the weir, unknown), one other female that did not spawn, and two males that did not spawn through natural means or human intervention.

There is no information regarding past takes of listed Puget Sound Chinook available. This is due to the previously described lack of survival of natural fish spawning below the weir (see Section 2.2.2) and the lack of external marking to differentiate hatchery fish from the listed fish.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

This Big Beef chinook hatchery will undergo a constant review for possible take situations. If the review indicates an unacceptable level of take then a solution will be negotiated with the co-managers.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

The Big Beef Creek fall chinook program is conducted in a manner consistent with the Hood Canal Summer Chum Conservation Initiative. Specifically, chinook are not released until after April 1 in order to reduce potential interactions with listed Hood Canal summer chum..

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operate.

This HGMP is consistent with relevant standing orders and agreements. The Puget Sound Salmon Management Plan (PSSMP) and the Hood Canal Salmon Management Plan (HCSMP) are federal court orders that currently control both the harvest management rules and production schedules for salmon in Hood Canal under the *U.S. v. Washington* management framework. The parties to the SCSCI recognize that it may be necessary to modify these plans in order to implement the recommendations that will result from the SCSCI. However, the provisions of the PSSMP and HCSMP will remain in effect until modified through court order by mutual agreement.

The Big Beef Chinook project operates within the overview of a technical work group comprised of representatives of all of the relevant co-managers: USFWS, WDFW, NMSF, Point no Point Treaty Tribes, Skokomish Tribes, HCSEG, LLTK. The evaluation of the success of the program will be directly tied to how it affects the listed species in the area.

3.3) Relationship to harvest objectives.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Tribal and non-Indian commercial and recreational fisheries directed at fall chinook and other species produced through WDFW hatchery releases will be managed to minimize incidental effects to listed chinook salmon and summer chum salmon. Time and area, gear-type restrictions, and chinook and summer chum release requirements will be applied to reduce takes of listed salmon in the Hood Canal mainstem, extreme terminal marine area, and river areas where these fisheries directed at other hatchery species occur. Compliance with the fisheries management strategy defined in the SCSCI will lead to fisheries on WDFW hatchery-origin stocks that are not likely to adversely affect listed chinook or listed summer chum.

Each year, state, federal and tribal fishery managers plan the Northwest's recreational and commercial salmon fisheries. This pre-season planning process is generally known as the North of Falcon process, which involves a series of public meetings between federal, state, tribal and industry representatives and other concerned citizens. The North of Falcon planning process coincides with meetings of the Pacific Fishery Management Council, which sets the ocean salmon seasons at these meetings.

For example, during 2000 as an outcome of the North of Falcon process, the state/tribal Puget Sound Chinook Harvest Management Plan (enclosed in letter from Billy Frank, Jr., NWIFC and Jeff Koenings, WDFW to Will Stelle, NMFS, dated February 15, 2000) contained proposals for the 2000/2001 fishing season.

For the 2001/2002 season, the co-manager's have prepared a Harvest Management Plan for Puget Sound Chinook Salmon. The Plan states specific objectives for harvest of the 15 Puget Sound management units, the technical bases for these objectives, and procedures for their implementation. The Plan assures that the survival and recovery of the Puget Sound ESU will not be impeded by fisheries-related mortality. The Plan is being submitted with the expectation that NMFS will reach a finding, based on the conditions stated in the 4(d) rule, that fisheries-related take in Washington waters is exempt from prohibition under Section 9 of the ESA. NMFS is/has currently reviewing/ed the Plan.

3.4) Relationship to habitat protection and recovery strategies.

Hood Canal chinook Limiting factors analyses have not been completed for Hood Canal natural chinook stocks and factors for decline and recovery are not available. However, since listed chinook and listed summer chum utilize similar habitats, habitat protection and recovery strategies designed to recover summer chum (see below) will also aid in the recovery of listed Hood Canal chinook.
The principle chinook streams in Hood Canal, the Skokomish, Hamma Hamma, Duckabush, Dosewallips and Big Quilcene rivers are on the westside of Hood Canal. They provide spawning and rearing habitat only in the lower river sections with relatively low gradients. Gradients rapidly become steep with impassable waterfalls, so most of these rivers are not accessible to chinook. All of these rivers, especially the Skokomish and Big Quilcene have suffered damage from human activities (dams, roads, logging, diking, agriculture and development) which have exacerbated natural summer low flows, winter flooding and streambed scouring, and sediment deposition due to unstable soils and slopes. Large woody debris is lacking in most areas used by chinook as a result of forest practices. In the Skokomish, the Cushman hydropower project on the North Fork has reduced stream flow in the Skokomish by about 40% and has altered the normal pattern of sediment delivery to the estuary with the result that eelgrass has been lost (WDFW and WWTIT 1994). Gravel aggradation and removal have been problems in the lower Big Quilcene.

Summer chum Summer chum supplementation, habitat restoration and management measures are integrated as presented in the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000). The SCSCI provides a standardized approach to determine freshwater and estuarine limiting factors in each summer chum watershed. Habitat factors for decline and recovery for each watershed are described. In addition, at the summer chum ESU scale, protection and restoration strategies for each limiting factor for decline are provided. The goal of the habitat protections and restoration strategy is to maintain and recover the full array of watershed and estuarine-nearshore processes critical to the survival of summer chum across all life stages. Hood Canal summer chum in westside Hood Canal streams (Lilliwaup Cr., Hamma Hamma, Duckabush, Dosewallips, Big Quilcene and Little Quilcene are affected by much the same habitat conditions as Hood Canal chinook, especially by habitat perturbations such as diking, streambed instability/gravel aggradation in the lower stream reaches. On the eastside, Hood Canal summer chum streams such as the Union River and Big Beef Creek are low elevation, low gradient streams which are being heavily impacted by rapid development on the Kitsap Peninsula. Logging and associated road construction have historically created conditions that increased sediment delivery to streams and reduced the supply of large woody debris to streams.

3.5) Ecological interactions.

Summer Chum The SCSCI provides an assessment of risks to summer chum juveniles and adults posed by the production of George Adams Hatchery fall chinook, summer chum risk averse measures to implement, and monitoring and evaluation measures to be applied to minimize any risks.

Fall Chinook The risks and benefits posed by hatchery-origin juvenile chinook to wild juvenile chinook will depend on the number, size and release time and stream residence time of the hatchery fish. Big Beef Creek releases approximately 200,000 fingerling smolts annually.

3.5.1) Relevant ecological interactions that might negatively impact the program in Big Beef Creek and the estuary involve predation by wild searun and resident cutthroat trout, freshwater and marine sculpin, wild coho salmon smolts, and a variety of birds (gulls, kingfishers, dippers, etc.).

3.5.2) Chinook releases could increase competition and localized depletion of prey resources for other fishes if significant temporal and spatial overlap among potential competitors occurred in the estuary.

3.5.3) Invertebrate production in the creek, estuary, and nearshore marine areas may provide an important initial natural food supply, acclimation to the natural environment, and an initial boost in growth before continuing early marine migration.

3.5.4) Chinook releases could provide an episodic, but significant supply of prey to native fauna in the stream, estuary, and nearshore marine regions.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

The chinook hatchery at Big Beef is supplied with well water from a 350' production well and delivered by an artesian gravity-fed flow system with electrical pump backup system that has an emergency generator system for backup in times of electrical outage. A shallower (120') artesian well with electrical pumping system provides backup to the primary production well.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The hatchery at Big Beef is supplied with well water and does not withdraw water from Big Beef Creek. The well water is a gravity-fed system (siphon). A pump system is being developed and will be used in combination or as back up to the gravity-fed system. The pump has an emergency backup generator system on line at all times.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Returning adult chinook are trapped in a permanent, wooden 8-foot by 12-foot fish trap on the north side of experimental Pond #4 within the research facility. Entrance to the pond is via culvert off the east side of the creek below the weir. The facility is owned by the University of Washington and operated and managed by full-time UW personnel within a secure facility.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Adult chinook are netted in the trap and carried to the tanks. Chinook fry are transported only once; fry in Heath trays are carried to and placed in 20-foot x 4.5 foot circular tanks for rearing.

5.3) Broodstock holding and spawning facilities.

Adult chinook are placed in 20-foot circular tanks that are 4.5-feet high.

5.4) Incubation facilities.

Chinook eggs are incubated in Heath trays.

5.5) Rearing facilities.

Juvenile chinook are reared in 20-foot circular tanks that are 4.5-feet high.

5.6) Acclimation/release facilities.

Chinook fingerlings are not imprinted on Big Beef Creek water. They are released from the 20-foot circular tanks through a drain in the center of each tank that is piped to a drainage channel. This drainage empties directly into settling ponds that connect to the Big Beef estuary directly downstream of the weir.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

Since 1990 there have been no difficulties or disasters that have led to significant fish mortality.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

The hatchery is staffed full-time, is equipped with a low-water alarm system, and is equipped with a back up generator to help prevent catastrophic fish loss resulting from water system failure. Hatchery chinook are virology tested when spawned to prevent disease and proper loading specifications are followed according to the Fish Health Manual, WDFW. Multiple artesian wells provide abundant water supplies.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Since 1993, the source at Big Beef Creek is adults returning to the weir. The historical source of broodstock came from Finch Creek, Hood Canal's Hoodsport Hatchery, in the late 60's. The next source of broodstock was returning chinook to Big Beef Creek from 1970 to present except for one instance in 1993 when chinook returns were low and eggs from George Adams Hatchery (which included eggs from Deschutes Hatchery) were transferred to Big Beef (Fish Transfer Records, WDFW).

The Hoodsport stock was started in 1952 with a release of Dungeness spring/summer chinook. This was followed by several years of Soos Creek (Green River) releases until the stock became (largely) self sustaining at Hoodsport. Additional inputs at Hoodsport include chinook from Tumwater Falls (largely derived from Soos Creek), Voights Creek (Puyallup basin), Big Beef Creek, Minter Creek and Trask River, Oregon hatchery populations.

6.2) Supporting information.

6.2.1) History.

Chinook salmon from Hoodsport Hatchery were accidentally introduced (planted) into Big Beef Creek in the late 1960's by the hatchery operated there by the University of Washington (Analysis of Scale Samples from Chinook Salmon Entering Big Beef Creek, Washington by Lawrence D Ratte, 1983). Starting in 1970, the U of W hatchery collected broodstock from the returning adults at Big Beef for artificial propagation. This broodstock collection continued without the transfer of eyed eggs from another hatchery except for the year 1993, when 50,000 eyed eggs were transferred from George Adams Hatchery (46,500 Deschutes stock and 3,500 George Adams stock) because of an overall decrease of chinook runs that year (WDFW Fish Transfer Records, 1993). After 1993, only returning chinook were used for broodstock for the Big Beef Creek Chinook Project.

Broodstock for this program originated from Finch Creek (Hood Canal's Hoodsport Hatchery). The Green River fall chinook stock originated from adults collected in the Green River. The stock was propagated at the Soos Creek Hatchery and disseminated widely throughout Puget Sound hatcheries. The hatchery began operation in 1901, and we assume that fall chinook broodstock collection began at that time. Dungeness chinook are a spring/summer stock native to the Dungeness. They were not successfully introduced at Hoodsport and may not have contributed significantly to the George Adams stock. The Voights Creek stock originated from Voights Creek chinook but had significant infusions of Soos Creek fish. The Minter Creek fall chinook stock is a Soos Creek derivative via Soos Creek and the Deschutes. Trask River chinook stock are derived from Tillamook Bay tributary stock.

6.2.2) Annual size.

One hundred percent of hatchery chinook must be collected at Big Beef weir. A maximum of seventy pairs are needed for broodstock for the project. Total number of fish returning to the weir has ranged between 8 and 1000 (for listing of annual total number of fish returning to the weir see Section 1.12).

6.2.3) Past and proposed level of natural fish in broodstock.

There is no available data for how many natural chinook were incorporated into the broodstock because the hatchery chinook have not been marked to date. There is no intent to incorporate wild chinook into the broodstock. The intent is to collect localized hatchery-origin broodstock at this location.

6.2.4) Genetic or ecological differences.

There are no known genotypic, phenotypic, or behavioral differences between current and proposed hatchery stocks. There is very little known about the genetic makeup of the stock at Big Beef because there has been no GSI (allozyme) or DNA analysis done on them to date; samples were collected in 2000. They are believed to be similar to George Adams and Hoodsport Hatchery stocks.

6.2.5) Reasons for choosing.

Locally adapted stock.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

There is no way to tell the difference between wild origin and hatchery origin adults at the time of spawning. We propose that hatchery chinook are marked from now on by clipping the adipose fin, however, this action must be approved by the Co-Managers. No hatchery origin adults will be allowed to spawn naturally in Big Beef Creek.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Returning adult chinook salmon will be collected at the Big Beef weir for spawning.

7.2) Collection or sampling design.

Returning adult chinook are collected at river kilometer 0.1 of Big Beef Creek at a weir trap from the beginning of the run (mid-September) to the end (October) by netting them out of the trap. Capture efficiency is 100% at the weir for those fish that migrate beyond tidewater influence and an allotted number of chinook will be captured for broodstock each week to collect a representative sample of the broodstock source (maximum 70 pair). The weekly allotments will be determined by the Co-Managers, and chinook will be selected at random to make up the 70-pair maximum.

7.3) Identity.

To date, no hatchery chinook at Big Beef have been marked so there will be no method to identify chinook that may have been a result of natural spawning, upon capture of returning adults. We are proposing that hatchery chinook be marked, however, this must be authorized by the Co-Managers.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

The program goal is 70 pairs of hatchery chinook.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults				
1988	0	0	0	0	0
1989	0	0	0	0	0
1990	2	4	No data	6,500	0
1991	15	30	No data	62,000	0
1992	5	10	No data	70,000*	0
1993	9	18	No data	32,000	0
1994	15	30	No data	55,000	0
1995	118	236	No data	200,000	0
1996	67	134	No data	180,000	0
1997	39	78	No data	140,000	0
1998	59	118	No data	200,000	0
1999	73	146	No data	200,000	0
2000					
2001					

Data source: Gordon George, UW Big Beef Facility Manager, and Project Manager

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Surplus fish will be buried and/or disposed of on site. Subject to the approval of the co-managers, surplus hatchery chinook can be killed, sampled for virology, stored, and distributed to various co-op projects for nutrient enhancement in Big Beef Creek or other Hood Canal tributaries.

7.6) Fish transportation and holding methods.

Hatchery chinook will be captured at the Big Beef weir trap with nets and carried approximately 50-100 feet to 20 foot circular tanks where they will remain until they are ripe. They will be spawned on site.

7.7) Describe fish health maintenance and sanitation procedures applied.

All hatchery chinook captured for broodstock will be virology tested in accordance with procedures set forth in the "Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (WDFW 1996). Artificial spawning will occur in sterile containers that will be cleaned after each use. Fish health measures will be consistent with the co-managers fish health policy (NWIFC and WDFW 1998).

7.8) Disposition of carcasses.

Surplus fish will be buried and/or disposed of on site. No chinook adults will be passed upstream to spawn naturally in the Big Beef Creek watershed. Subject to approval by the Co-Managers, spawned and unspawned carcasses will be virology tested and distributed to various co-op projects for nutrient loading in Big Beef or various Hood Canal rivers. At such time that permission for carcass distribution is received, and carcasses are distributed, a carcass distribution report will be made for each distribution site and shall be submitted to the Co-Managers.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

To reduce the risk of injury to listed natural fish, the weir trap will be checked a minimum of four times a day to remove hatchery chinook and deal with listed species as instructed by Co-Managers (it is currently unknown if summer chum will be passed up Big Beef Creek and/or be captured for artificial propagation since the population is so small).

Hatchery chinook are not currently marked so there is no distinction between chinook that are a result of natural spawning and artificially propagated chinook. We assume all returning chinook are hatchery-origin even though they may have been a result of natural spawning, because no chinook are allowed upstream which has been determined by the Co-Managers.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

When returning fish exceed the required number of pairs, spawners will be chosen randomly over the whole run to arrival timing. The number of pairs per week are chosen in proportion to the overall run return timing curve (based on previous run dates). There will be no selection between hatchery and natural returning chinook until hatchery chinook are allowed to be marked by the Co-Managers.

8.2) Males.

To preserve genetic diversity, paired matings of one male with one female (1x1) will be the minimum, but, when male numbers allow two males will be mated with each female. Chinook jacks will be used for spawning if they are selected in the random selection process. Repeat spawners are not anticipated.

8.3) Fertilization.

All chinook selected for broodstock will be virology tested for disease prevention and control. Fertilization will occur in sterile containers, which will be cleaned after every use.

8.4) Cryopreserved gametes.

There will be no cryopreserved gametes.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Not applicable.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding. .

Although official records were not maintained prior to 1990, egg survival rate (based on egg picking since 1990) is estimated at 95%. Fry survival after ponding exceeds 99%.

9.1.2) Cause for, and disposition of surplus egg takes.

If the number of eggs exceeds the maximum egg take goal of 200,000, the excess will be destroyed before release as juvenile chinook, or will used in experiments (e.g., predation, survival, and behavioral studies by UW or NMFS) and then destroyed.

9.1.3) Loading densities applied during incubation.

Heath trays will be loaded with 3500-5000 eggs per tray with an incubator flow of 5 gallons per minute (gpm). Egg size data is not available.

9.1.4) Incubation conditions.

The incubators are supplied with well water and are not subject to sediment problems. Eggs will be monitored for health and will be shocked and picked after eyeing.

9.1.5) Ponding.

Swim up and ponding are forced. After alevins become fry, they will be transferred to 20 foot circular tanks for ponding.

9.1.6) Fish health maintenance and monitoring.

Fish health will be is monitored on a routine basis by a Fish Health Specialist. If needed, treatment plans are prescribed in accordance with the WDFW Fish Health Manual and Policies. Heath trays will be kept as clean as possible during the sensitive stage of the eggs before eyeing. After the eggs are eyed, they will be shocked and picked with egg pickers by hand from the tray. Trays will be monitored for fungus and cleaned routinely until hatching occurs.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Eggs are incubated using well water, which minimizes the risk of catastrophic loss due to siltation.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

Based on observations since 1990, fry survival after ponding to release exceeds 99%.

9.2.2) Density and loading criteria (goals and actual levels).

Rearing densities are per "Piper et. al. Fish Hatchery Management, USFWS 1982."

9.2.3) Fish rearing conditions

Fish are reared in 20' circular fiberglass tanks within a secure tank installation within the NMFS compound on the UW property. Water temperature is a constant 50 degrees Fahrenheit (from well source) and monitored by NMFS staff on site. Water is oxygenated via a 3' packed column. Minimal handling procedures are observed.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

In order to minimize handling of the smolts, sampling is done once per month. Approximately 200 fish are weighed and counted to check density and adjust feeding. Records are unavailable.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Section 9.2.4

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Food is provided to the hatchery by the co-managers. *Biomoist* feed is provided for the fish. Fish are fed in accordance with recommended body weight ratios provided by the feed vendor.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Juvenile chinook will be monitored for health and a fish health specialist will monitor problems if any and examine fry before release. Loading will be determined based on proper loading specifications form WDFW Fish Health Manual.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Behavioral and external clues are used to judge the degree of smolting of the fingerlings. Release timing is also scheduled to preclude interaction with Summer Chum fry in the marine waters of Hood Canal.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Loading is kept at a lower level. In past predation tests, cutthroat trout were introduced into certain ponds of tagged fry to monitor survival rates of returning adults with or without predation.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

Listed chinook are not knowingly propagated. Fingerlings will be liberated at a time and size to avoid interactions with listed summer chum.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling	200,000	80 fpp	First week of May	Big Beef Creek
Yearling				

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Big Beef Creek (15.0389)
Release point: River mile 0.1 of Big Beef Creek
Major watershed: Big Beef Creek
Basin or Region: Hood Canal (Puget Sound)

10.3) Actual numbers and sizes of fish released by age class through the program.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988					0	0		
1989					0	0		
1990					6,500	50 fpp		
1991					62,000	50 fpp		
1992					70,000	50 fpp		
1993					32,000	50 fpp		
1994					55,000	50 fpp		
1995					200,000	80 fpp		
1996					180,000	80 fpp		
1997					140,000	80 fpp		
1998					200,000	80 fpp		
1999					200,000	80 fpp		
2000								

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
2001								
Average								

Data source: Gordon George, UW Big Beef Facility Manager, and Project Manager.

10.4) Actual dates of release and description of release protocols.

Annual releases are the first Saturday of May (May 6, 2000; May 1, 1999; May 2, 1998; May 3, 1997; May 4, 1996).. Method of release is forced from the tanks into settling ponds that drain into the estuary. From there they may leave volitionally.

10.5) Fish transportation procedures, if applicable.

Juvenile chinook are released through a piped system from tanks into Big Beef settling ponds (number 3, 4, and 5) and from there, into the estuary. There is no transportation by hatchery workers.

10.6) Acclimation procedures

Hatchery chinook are forced released from the fiberglass rearing tanks into the UW's research ponds (pond numbers 3, 4, 5) where they acclimate and migrate volitionally into the estuary below the weir on Big Beef Creek.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

To date, there has not been any consistent marking of hatchery chinook. In 1993, 32,000 fish were coded-wire tagged and released in a cooperative research project with NMFS (Barry Berejikian).

With co-manager agreement, WDFW will apply an identifiable mark to 100% of the fall chinook production released through the Big Beef Creek hatchery program each year to allow monitoring and evaluation of the hatchery program fish releases and adult returns. Coded-wire tagging of a portion of the fall chinook production will be considered to allow for evaluation of fishery contribution and survival rates, and stray levels to other Puget Sound watersheds.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Surplus chinook will be destroyed.

10.9) Fish health certification procedures applied pre-release.

Fry will be examined by a fish health specialist before release, in accordance with the co-managers Salmonid Disease Policy.

10.10) Emergency release procedures in response to flooding or water system failure.

The fingerlings leave through a pipe system from the rearing tanks to settling ponds connected to the estuary. If there was a total water system failure, they could be emergency released, however, there is an alarm system and a back up generator to help prevent emergency release. Flooding is not anticipated as a problem because rearing tanks are run with well water.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Chinook are released as smolts in early May, well after summer chum salmon fry releases, which have typically been in February. Limiting juvenile production to current (proposed) levels will help retain, and not forestall, potential future options for the recovery of the listed chinook ESU.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

It is intended that all "Performance Indicators" identified in section 1.10 will be monitored and evaluated. Complete funding for all activities has not been secured.

To date, the following "Performance Indicators" **addressing benefits** have been monitored:

1) Monitor the number of returning adults and eggtakes weekly to determine whether goals are being met.

2) Publish agreed-to production plans (Future Brood Document) with PNPTC tribes and other stakeholders.

3) Acquire needed permits (e.g. approved HGMP) to ensure that the Hood Canal fingerling fall chinook program satisfies ESA recovery requirements for listed fish.

4). The release date of Big Beef chinook will be a celebration of salmon for local communities.

To date, the following "Performance Indicators" **addressing risks** have been monitored:

5). The number of adults used in the hatchery project will meet or exceed the minimum population size.

6). Adult chinook will be collected for spawning over the entire duration of the run to ensure that differences in return timing are preserved in the population.

7). Genetic Stock Identification (GSI) allozyme collections will be taken from all hatchery chinook spawned for comparison with future generations to monitor allelic characteristics.
8). DNA samples will be collected and archived for future analysis.

9).HCSEG/UW will determine if hatchery stock procurement methods are collecting the required number of adults that represent the demographics of the population with minimal injuries and stress to the fish.

a) Monitor operation of adult capture operations, ensuring compliance with established broodstock collection protocols.

b) Monitor timing, duration, composition, and magnitude of the run.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Funding, staffing and support are available and committed for Monitoring and Evaluation at the current level as described in 11.1, above. Funding and resources are currently committed to monitor and evaluate this program as detailed in the Resource Management Plan for Puget Sound Chinook Salmon Hatcheries (Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, August 23, 2002)

Additional funds are needed to support expanded monitoring and evaluation, including data collection and compilation and support for allozyme, DNA and otolith collections and analyses.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

It is anticipated that adherence to monitoring and evaluation protocols provided by the co-managers will not elevate risk to listed fish.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Study 1. Fish used in study = 3,600 fry/year. Depressed salmonid species including those listed under ESA are frequently taken into artificial propagation programs. While these programs typically ensure high in-culture survival, the post-release fitness is generally poor. The objective of this study is to develop anti-predator conditioning protocols to improve the post-release survival of hatchery-reared salmonids. The approach is to develop conditioning protocols using chemical alarm signals, so that no cultured fish are harmed during the conditioning events.

Study 2. Fish used in study = 3,500 fry/year. Erythromycin is routinely used to prevent epizootics of bacteria kidney disease in captively reared populations of endangered salmonid broodstock, but little is known about its long-term efficacy, toxicity, or long-term effects on gamete quality. The objective of this study is to evaluate the effects of erythromycin and a chemically similar antibiotic, azithromycin, on gamete quality and reproductive performance of chinook salmon broodstock. Results of this work will be used to develop treatment protocols that minimize risks to captive reared populations of endangered salmon.

12.2) Cooperating and funding agencies.

Study 1. NMFS in cooperation UW and HCSEG are collaborating on the study. Funding is provided by the Bonneville Power Administration.

Study 2. NMFS is conducting this Bonneville Power Administration-funded study.

11.3) Principle investigator or project supervisor and staff.

Study 1. Dr. Barry Berejikian (NMFS)

Study 2. Drs. Mark Strom and William Fairgrieve (NMFS)

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Study 1. Only stock affected is the non-listed chinook salmon hatchery stock identified in section 1.

Study 2. Only stock affected is the non-listed chinook salmon hatchery stock identified in section 1.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Study 1. Approximately 3,600 emergent chinook salmon fry were provided by UW to NMFS. Fish were stocked into a single rearing vessel for artificial propagation. They will eventually be divided into 2 tanks. Effluent from the rearing tanks is UV-sterilized to remove any pathogens from the water prior to its return to Big Beef Creek.

Study 2. Emergent chinook salmon fry were provided by UW to NMFS. Fish were stocked in 14 tanks for rearing to the smolt stage when they were pit-tagged and re-assigned to 6 tanks for rearing to maturity. Erythromycin or azithromycin were administered at various intervals and samples collected to monitor drug uptake and retention, toxicity effects, and efficacy.

12.6) Dates or time period in which research activity occurs.

Study 1. Research was initiated on 25 January 2000 and will continue through 30 July 2000, and may be repeated in subsequent years.

Study 2. Research was initiated in January 1999 and will continue until December 2001.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Study 1. Fish are maintained under standard hatchery protocols. They will be periodically transferred to NMFS Manchester Field Station by NMFS personnel via NMFS truck and to the for behavioral studies. No fish will be released from the rearing tanks.

Study 2. Fish are maintained using standard hatchery rearing procedures. Live fish will not be removed from the site at any time. Tissue samples will be periodically transferred to the pathology laboratory at Montlake (Seattle).

12.8) Expected type and effects of take and potential for injury or mortality.

Study 1. All fish will be sacrificed at the end of the experiments.

Study 2. All fish will be sacrificed at the end of the experiment.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Study 1. No listed fish will be handled, injured, or killed.

Study 2. No listed fish will be handled, injured, or killed.

12.10) Alternative methods to achieve project objectives.

Study 1. Obtain chinook salmon and rearing facilities at a location other than Big Beef Creek

Study 2. No other facilities available to conduct NMFS research on on-site fish.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Study 1. No injury or mortality will be incurred by other species.

Study 2. No injury or mortality will be incurred by other species.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Study 1. The only fish used in this study are non-listed chinook salmon, which will be sampled from the hatchery rearing vessels. No other fish or animals will be collected or affected in any way. The predators used in the study will be collected from the Columbia River and will be transported directly to the Manchester Field Station.

Study 2. The only fish used in this study are non-listed chinook salmon, which will be sampled from the hatchery rearing vessels. No other fish or animals will be collected or affected in any way. No releases of treated animals will occur.

SECTION 13. ATTACHMENTS AND CITATIONS

Moring, 1973. Aspects of growth, and the effects of some environmental factors on pen-reared chinook salmon, *oncorhynchus tshawytscha (*walbuam), in Puget Sound, WA. UW Ph.D. Thesis.

Ratte, L.D., Salo, E., 1983. Analysis of Scale Samples from Chinook Salmon (Onchorhynchus Tshawytscha) Entering Big Beef Creek, Washington. June 1, 1983.

WDFW, Western Washington Treaty Tribes. 1992. Washington State Salmon and Steelhead Stock Inventory. Hood Canal and Strait of Juan De Fuca Volume, December 1994

WDFW, 1996. State of Washington Fish Health Manual, Hatcheries Program Fish Health Division. November 1996.

Washington Department of Fish and Wildlife and Point No Point Treaty Tribes. 2000. Summer Chum Salmon Conservation Initiative: An Implementation Plan to Recover Summer Chum Salmon in the Hood Canal and Strait of Juan de Fuca Region. Jim Ames, Gary Graves, and Chris Weller, editors. Fish Program, Washington. Department of Fish and Wildlife, Olympia. 423 p. + app.

Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, 2002, "Puget Sound Chinook Salmon Hatcheries, Resource Management Plan", a component of Comprehensive Chinook Salmon Management Plan, August 23, 2002. 103 pages.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook Salmon **ESU/Population:** Puget Sound Chinook **Activity:** Big Beef Chinook Hatchery				
Location of hatchery activity: Big Beef Creek, WRIA 15.0389 **Dates of activity:** August through May **Hatchery program operator:** Gordon George				
Type of Take	Annual Take of Listed Fish By Life Stage ***(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)	0	0		0
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)	0	0	0	0
Intentional lethal take f)	0	0	0	0
Unintentional lethal take g)	unknown	unknown	unknown	0
Other Take (specify) h)				

* There is currently no way to distinguish hatchery chinook from naturally spawning chinook because hatchery chinook have never been marked. However, no chinook are allowed into Big Beef Creek above the weir as instructed by the Co-Managers. Therefore, it is assumed that all naturally spawning chinook in the Big Beef Creek system are hatchery-origin chinook. Take estimates of progeny from naturally spawning chinook are inconclusive.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.